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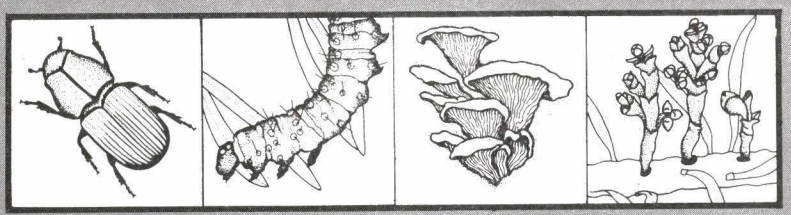
Forest Pest Management



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SUMMARY OF FOREST INSECT AND DISEASE CONDITIONS IN THE NORTHERN REGION - 1980

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CONDITIONS IN BRIEF

Major mountain pine beetle infestations persist on five National Forests and two National Parks in the Region and less serious infestations exist on several other Forests. The trend throughout the Region is an increase in beetle losses in nearly all areas of susceptible host. In 1980, beetle infestations covered more than 1.7 million acres of lodgepole pine forests. Another 150,000 acres of western white pine, ponderosa pine, and whitebark pine have epidemic mountain pine beetle populations. Only minor damage resulted from other bark beetle species. Western spruce budworm defoliation dropped to its lowest level in 25 years. Larch casebearer defoliation declined substantially on forests in northern Idaho and northwestern Montana; however, increased activity occurred in west-central Montana. A new budworm, Argyrotaenia sp. continued its spread and now defoliates more than 11,000 acres. Douglas-fir tussock moth populations remain very low. The forest tent caterpillar outbreak that has persisted in the Turtle Mountains of North Dakota for the past several years has now declined to a few small spots of defoliation.

Dwarf mistletoes and root diseases are the two most important groups of diseases in the Northern Region. Impact surveys completed for National Forests in Montana indicated that more than 18 MM cu. ft. of lodgepole pine, Douglas-fir, and western larch volume is lost annually to dwarf mistletoes. Similar surveys planned for northern Idaho should improve dwarf mistletoe loss estimates there. Root diseases are widespread and seriously impact timber management of numerous forest stands. Initial impact surveys on the Coeur d Alene, Kaniksu, St. Joe, and Lolo National Forests indicated that almost 60,000 acres of commercial forest land were occupied by large root disease centers detectable from the air. Much small group and individual tree mortality was not accounted for in these surveys; future impact evaluations will include tree mortality and volume loss estimates.

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Several foliage diseases were severe due to prolonged wet weather during the growing season. Needle diseases were especially noticeable on western larch in northern Idaho and western Montana and in a ponderosa pine plantation in eastern North Dakota. Dutch elm disease continued to cause serious losses in Billings, Montana, and several communities in eastern North Dakota. Disease incidence was low in native woodlands of eastern North Dakota. White pine blister rust continued to cause significant losses to white pine in northern Idaho. Several nursery diseases, including tip blight of Engelmann spruce and ponderosa pine and grey mold of containerized conifers were damaging in northern Idaho.

STATUS OF INSECTS

Mountain Pine Beetle: *Dendroctonus ponderosae* Hopk.

The mountain pine beetle is the most destructive forest pest in the Northern Region. Though it attacks all pine species within its range, the most serious tree-killing occurs in mature lodgepole pine stands. In such stands, the beetle kills the largest trees each succeeding year until the stands are so depleted they can no longer support epidemic populations.

Mountain pine beetle populations are currently at epidemic levels on the Gallatin, Kootenai, Lolo, Beaverhead, and Flathead National Forests and in Glacier and Yellowstone National Parks. Less serious infestations exist on several other Forests in the Region. In 1980, beetle infestations covered more than 1.7 million acres of lodgepole pine type, 131,000 acres of whitebark pine, nearly 16,000 acres of ponderosa pine, and 3,400 acres of western white pine (figure 1).

The most acute problems are in the Flathead and Gallatin National Forests, Montana. Infestations on those Forests are beginning to wane on Districts where epidemics have been extant for from 6 to 8 years. The beetle is continuing to attack uninfested susceptible stands, however.

In Glacier National Park, beetle populations are declining in the North Fork of the Flathead River drainage, but increasing in green stands on the east side of the Park. Yellowstone National Park is experiencing renewed tree-killing in previously infested areas. Significant infestations continue to plague State and private lands throughout the Region as well.

A multistage sampling survey to assess lodgepole pine mortality attributable to the mountain pine beetle in Montana was conducted in 1979. Results of that survey indicate approximately 11.6 million lodgepole pine, representing 161.4 million cubic feet of timber, were killed in 1978 (percent standard error 9.8 and 16.5 percent for trees killed and volume, respectively). The same survey estimated 9.9 million trees were killed in 1979 (percent standard error 29.9) containing 167.1 million cubic feet of volume (percent

standard error 38.9). Total number of standing dead lodgepole killed by the beetle through 1979 was estimated at 33.4 million trees (517 million cubic feet volume).

Variable plot cruises to determine mortality estimates for 1980 were completed recently. Those data, representing selected areas within each infestation are shown in table 1.

Table 1. 1980 Mountain pine beetle mortality on surveyed areas.

Forest	District	Trees/acre killed 1/	Cubic ft vol/ac killed	Infestation trend
Gallatin	Bozeman	19.7	372.3	Static
	Hebgen Lake	10.3	136.4	Decreasing
Beaverhead	Ennis	27.1	461.1	Static
Lolo	Plains	27.7	196.0	Increasing
Kootenai	Fisher River	13.9	151.0	Static
	Yaak	14.1	228.9	Static
Flathead	Glacier View	12.3	56.6	Decreasing
	Tally Lake	6.4	112.7	Increasing
Glacier NP	--	29.2	121.5	Decreasing 2/
Yellowstone NP	--	20.5	305.6	Static

1/ Not District-wide averages--averages for areas surveyed only.
2/ Decreasing west of Continental Divide but building on East Side.

Most lodgepole pine stands on National Forest lands in the Region have been hazard rated for susceptibility to the beetle. Hazard rating and attendant management are the only feasible means to reduce or prevent unacceptable beetle-caused mortality.

Other Bark Beetles

Populations of the Douglas-fir beetle, Dendroctonus pseudotsugae Hopk., western balsam bark beetle, Dryocoetes confusus Sw., Engelmann spruce beetle, Dendroctonus rufipennis (Kby.), and pine engraver beetle, Ips pini (Say) remained quite static at relatively low levels in 1980. Greatest losses were caused by the western balsam bark beetle. It killed an estimated 2,475 trees on the Flathead NF, 1,325 trees on the Beaverhead NF, and 1,055 trees on the Gallatin NF.

Western Spruce Budworm: Choristoneura occidentalis Free.

For the first time since 1967, less than 2 million acres of budworm caused defoliation was detected during the annual aerial survey of the Region. Only 976,072 acres of budworm defoliation were mapped in 1980. Two new small areas of defoliation occurred on the Clearwater and Idaho Panhandle NF's. Substantial increases, i.e., 25,537, 184,198, and 50,435 acres of defoliation occurred on the Custer and Gallatin NF's, and Yellowstone NP respectively. Major declines in defoliation were recorded on the remainder of the National Forests of Montana (table 2). Location of defoliation visible from the air is shown on figure 2.

Record precipitation fell during May and June providing near optimal conditions for foliage growth but very poor conditions for larval development. We suspect this masked defoliation and that a population decline of the magnitude suggested by the reduction of defoliated acres mapped did not really occur. Limited larval and egg mass sampling supports this hypothesis. Hence, a resurgence in the number of acres defoliated is expected in 1981.

Table 2 - Western spruce budworm defoliation in the Northern Region
1979 and 1980

Unit 1/	Acres of visible defoliation 2/		Change in size of defoliation	
	1979	1980		Acres
NORTHERN REGION				
Bitterroot NF	10,845	850	-	9,995
Clearwater NF	0	320	+	320
Idaho Panhandle NF's	0	600	+	600
Nezperce NF	0	0		0
Subtotal	10,845	1,770	-	9,075
MONTANA				
Beaverhead NF	349,889	179,215	-	170,674
Bitterroot NF	84,487	3,860	-	80,627
Custer NF	5,373	30,910	+	25,537
Deerlodge NF	402,638	27,004	-	375,634
Flathead NF	1,803	0	-	1,803
Flathead IR	3,523	0	-	3,523
Gallatin NF	325,921	510,119	+	184,198
Helena NF	463,175	3,630	-	459,545
Kootenai NF	1,438	0	-	1,438
Lewis & Clark NF	211,493	57,112	-	154,381
Lolo NF	85,827	7,290	-	78,537
Garnet Mtns. (BLM) 3/	249,485	29,202	-	220,283
Subtotal	2,185,052	848,342	-	1,336,710
WYOMING				
Yellowstone NP	75,525	125,960	+	50,435
GRAND TOTAL	2,271,422	976,072	-	1,295,350

1/ Infested acreage includes Federal, State, and private lands.
2/ Aerially visible defoliation occurs when 25 percent or more of current foliage is destroyed.
3/ This unit has previously been included in the Lolo NF total.

Larch Casebearer: Coleophora laricella (Hbn.).

Detectable larch casebearer defoliation declined substantially on National Forests of northern Idaho and northwestern Montana in 1980 from 1979. On the Panhandle National Forests, 4,899 acres of defoliation were attributed to the casebearer in 1980 compared to 19,424 acres in 1979. Fifty acres of casebearer defoliation were observed on the Clearwater National Forest in 1980 compared to 5,125 acres in 1979.

An increase in defoliation occurred in the southern portions of the larch range in Montana. Aerially visible defoliation was noted for the first time at three areas in the vicinity of Missoula. These areas are the upper Blackfoot drainage, the Clark Fork River drainage east to Drummond, and the Bitterroot drainage south to Stevensville.

Cone and Seed Insects

Nineteen hundred and eighty was a better than normal year for cone production in many of the 33 seed production areas throughout the Region that were surveyed for cone and seed insect injury. Sample cones were regularly collected from Douglas-fir, grand fir, western larch, Engelmann spruce, western hemlock, lodgepole pine, ponderosa pine, and western white pine. One half the cones were dissected and the remainder placed in insect rearing containers. Greatest cone injury (50-100 percent) occurred to Douglas-fir and western larch in areas infested with the western spruce budworm. Dioryctria spp. were very damaging to ponderosa pine cones in some areas in Montana. The mountain pine cone beetle Conophthorus monticolae Hopk. again caused serious losses to white pine cone production in northern Idaho.

A Budworm: Argyrotaenia sp. near gogana (Kft.).

The first documented report of this insect being a forest pest was in 1978 when it defoliated about 40 acres of mountain hemlock and other conifers north of Wallace, Idaho. The infestation has now spread onto the Kootenai NF in Montana, and in 1980 defoliation was conspicuous on more than 11,000 acres in the two States. Permanent injury, i.e., top killing and tree mortality, is occurring to the understory in the areas of most severe defoliation. Extensive larval mortality caused by natural enemies took place in 1980 giving hope of a population decline in 1981.

Large numbers of larvae were sent to the Insecticide Evaluation Project, Pacific Southwest Forest and Range Experiment Station for insecticidal screening. This could lead to the eventual registration of a chemical control alternative.

Douglas-fir Tussock Moth: Orgyia pseudotsugata McD.

Tussock moth populations were monitored with pheromone-baited sticky traps at 38 locations having a history of tussock moth activity. Moths were only caught at five locations, and the number of moths captured was too small to suggest an outbreak in 1981.

A Needle Miner in Ponderosa Pine: Coleotechnites sp.

The only report of defoliation caused by this insect in 1980 was light defoliation on the campus of the University of Montana in Missoula.

Cankerworms: Paleacrita vernata (Peck) and Alsophila pometaria (Harr.).

Spring and fall cankerworms continue to defoliate Siberian elm shelterbelts in North Dakota. Defoliation is causing branch dieback and predisposing the belts to other agents.

Forest Tent Caterpillar: Malacosoma disstria (Hub.).

The tent caterpillar infestation that since 1976 has defoliated the aspen stands of the Turtle Mountains in North Dakota continued to decline in 1980. Only a few scattered patches of defoliation were noticed during ground surveys. Previously defoliated stands show little or no effect of the prior year's defoliation.

STATUS OF DISEASES

Dwarf Mistletoes: Arceuthobium spp.

Dwarf mistletoes continued to seriously impact forest management throughout commercial forests in many portions of the Northern Region. Major dwarf mistletoes in the Region include those on lodgepole pine, Douglas-fir, and western larch. Dwarf mistletoe on ponderosa pine and limber pine also occur.

Impact surveys were completed for the National Forests of Montana during 1980 (table 3). Impact on State and private land is probably similar to that on adjacent National Forests. More than 18 MM cu. ft. of lodgepole pine, Douglas-fir, and western larch growth is lost annually due to dwarf mistletoes on Montana National Forests.

Table 3. Growth loss of lodgepole pine, Douglas-fir, and western larch caused by dwarf mistletoes in Montana.

National Forest	Tree species 1/	Stands infested (%) 2/	Volume loss	
			ft^3/acre/yr 3/	M ft^3/yr
Beaverhead	LP	52.4	6.1	1,291
Bitterroot	LP	44.3	7.9	467
	DF	43.2	20.0	3,258
	WL	40.0	20.0	32
Custer	LP	28.2	8.8	106
Deerlodge	LP	46.6	11.1	2,499
Flathead	LP	18.4	15.3	641
	DF	0.7	20.0	30
	WL	33.7	20.0	936
Gallatin	LP	42.0	7.6	500
Helena	LP	35.4	9.2	814
Kootenai	LP	22.5	18.5	2,250
	DF	1.4	20.0	126
	WL	15.3	20.0	902
Lewis & Clark	LP	36.6	10.0	1,541
Lolo	LP	22.6	6.9	701
	DF	17.4	20.0	2,122
	WL	30.0	20.0	240
Subtotals (All Forests)	LP	--	--	10,810
	DF	--	--	5,536
	WL	--	--	2,110
Total	All	--	--	18,456

1/ Tree species: LP - lodgepole pine; DF - Douglas-fir, WL - western larch.

2/ Estimates made from impact surveys done in 1978, 1979, and 1980.

3/ Estimates of lodgepole pine growth loss in ft^3/acre/year were made using RMYLD. Douglas-fir and western larch estimates were made from previous studies conducted in the Region.

Estimates of impact for Idaho (table 4) are not as accurate as those of Montana; systematic impact surveys for the National Forests in northern Idaho are scheduled to begin in 1981.

Most dwarf mistletoe management is accomplished during routine stand treatments. However, special dwarf mistletoe presuppression surveys were conducted on 2,393 acres within the Bitterroot and Lolo National Forests during 1980. These surveys will provide a basis for future special control projects. During the year, special dwarf mistletoe control was conducted on 357 acres within the Bitterroot National Forest.

Table 4. Growth loss of lodgepole pine, Douglas-fir, and western larch caused by dwarf mistletoes in northern Idaho 1/

National Forest	Tree species 2/	Stands infested (%)	Volume loss	
			ft^3/acre/yr	M ft^3/yr
Idaho Panhandle	LP	26.9	12.1	507
	DF	30.3	20.0	2,280
	WL	29.8	20.0	2,750
Clearwater	LP	26.9	12.1	634
	DF	30.3	20.0	1,736
	WL	29.8	20.0	96
Nezperce	LP	26.9	12.1	863
	DF	30.3	20.0	1,452
	WL	29.8	20.0	72
Subtotals (All Forests)	LP	--	--	2,004
	DF	--	--	5,468
	WL	--	--	2,918
Total	All	--	--	10,390

1/ Infestation and volume loss estimates were not obtained from systematic impact surveys; such surveys scheduled to begin in 1981.

2/ Tree species: LP - lodgepole pine; DF - Douglas-fir; WL - western larch

Root Diseases

Root diseases are widespread throughout Forests of the Northern Region. They occur in many forest habitat types and are especially serious west of the Continental Divide. Tree mortality is probably the major impact of root diseases. Bark beetles and wood borers often attack diseased trees, hastening mortality. Root diseases are probably associated with much of the scattered annual tree mortality attributed to insects and other causes. Although quantitative effects on growth and stand productivity are unknown, such losses are probably substantial.

Root disease impact surveys of large areas are needed to quantify losses and help establish management objectives and priorities. Initial surveys have been completed for the three National Forests in the Idaho Panhandle and the Lolo National Forest in western Montana. Table 5 summarizes results of these surveys which indicate that almost 60,000 acres of commercial forest land was occupied by large root disease centers detectable from the air. This conservative estimate excludes extensive small group or individual tree mortality attributable to root disease. Additional impact surveys are planned for several other National Forests in the Region. In time, the surveys will address tree mortality and volume loss in addition to infected areas.

Table 5. Acreage of root disease centers within commercial forest stands on the Coeur d'Alene, Kaniksu, and St. Joe National Forests of northern Idaho and the Lolo National Forest of western Montana.

National Forest	Total commercial acreage	Acreage with root disease centers 1/	Percent commercial land occupied with root disease center
Coeur d'Alene	589,188	30,049	5.1
Kaniksu	776,054	6,596	0.8
St. Joe	741,947	3,380	0.5
Lolo	1,620,022	19,796	1.2
Totals	3,727,211	59,821	1.6

1/ Estimated acreage based on large root disease centers detectable from the air. Scattered small group or individual tree mortality attributable to root disease not included.

One of the major root diseases in the Northern Region is laminated root rot of Douglas-fir and grand fir caused by Phellinus weirii (Murr.) Gilb. This disease is especially common in northern Idaho and northwestern Montana where large mortality centers were formed. Another widespread root disease is shoestring root rot, caused by Armillaria mellea Vahl. ex Fr. The fungus may occur alone or in conjunction with other fungi to form root disease complexes. Such a complex was discovered in Douglas-fir at several locations on the Lolo National Forest and Flathead Indian Reservation in Montana. Individual trees were found to be infected with both Armillaria and black stain root disease (Verticicladiella wageneri Kend.). Black stain infected small roots, often on trees without aboveground disease symptoms. Armillaria mellea was typically present at the root crown. Diagnosis of black stain was difficult because the stain usually could not be detected at the root collar in the presence of Armillaria. It appears that black stain may predispose trees to infection by Armillaria.

Black stain root disease was also found on lodgepole pine on the Helena National Forest in Montana; infected trees also had Atropellis cankers.

Other major root diseases in the Region include brown cubical butt rot (Phaeolus schweinitzii (Fr.) Pat.) and annosus root rot (Fomes annosus (Fr.) Cke.). The former is often associated with Armillaria on Douglas-fir and other conifers. Fomes annosus causes localized ponderosa pine mortality in previously cutover areas near Missoula and on the Flathead Indian Reservation in western Montana. Importance and distribution of these pathogens are unknown.

Larch Needle Cast: Hypodermella laricis Tub.; Meria laricis Vuill.

Larch needle cast was especially severe in the Region this year due to very wet spring weather. Trees of all ages were affected; the diseases were reported in mature stands as well as young regeneration. Needle cast caused by H. laricis was characterized by infected needles turning brown early in June followed by spur shoot necrosis. Meria laricis attacked needles throughout the growing season; infected needles were shed shortly after death.

Pine Needle Cast: Lophodermium sp.

A needle cast disease was reported causing defoliation to a ponderosa pine/red pine plantation in northeastern North Dakota. This disease was first found in 1977, but was not causing much damage. Sufficient inoculum buildup occurred to cause serious damage to ponderosa pine in 1980. Necrotic needles occurred to a height of 7 to 8 feet on trees that averaged about 20 feet tall. The causal organism was identified as a species of Lophodermium similar to a known pathogen of red pine. Damage was serious enough to warrant chemical control measures.

Dutch Elm Disease: Ceratocystis ulmi (Buism.) C. Mor.

This disease continued at epidemic proportions in Billings, Montana. However, an agressive sanitation program resulted in a reduced number of trees killed during 1980. Only 220 elms were killed in 1980, whereas 987 were killed and removed during 1979.

Dutch elm disease was confirmed in 26 cities in 12 counties of North Dakota in 1980. The disease was found for the first time in 11 cities this past year and was fairly widespread in the southeastern part of the State. Aerial surveys for Dutch elm disease in native woodlands along rivers and streams were conducted in eastern and east-central North Dakota. Incidence of the disease was 1-3 percent in the southeast part of the State, declining progressively to the north and northwest. The disease was concentrated into localized pockets. Overall incidence of Dutch elm disease in eastern North Dakota native woodlands was estimated at 0.1 percent.

White Pine Blister Rust: Cronartium ribicola J. C. Fisch.

This important disease of western white pine continues to cause significant losses in northern Idaho. Thousands of acres of National Forest lands are affected. Progress was made to develop resistant nursery stock; however, enough seedlings to meet Forest Service needs were not available. Selecting apparently resistant seed trees remained a viable silvicultural alternative in areas of severe infection.

Atropellis Canker: Atropellis piniphila (Weir) Lohm and Cash.

Atropellis cankers were common on lodgepole pine in western Montana. Infections resulted in bole deformation; tree mortality occurred when stems were girdled by perennial cankers. This disease did not usually affect management options unless extensive infection occurred in high use areas such as recreation sites.

Shelterbelt Diseases

During 1979 and 1980, extensive surveys of diseases in shelterbelt trees were conducted in five North Dakota counties. Field and farmstead shelterbelts were selected to represent a cross section of age, species composition, and site factors. Numerous diseases were found within shelterbelts; some were previously unreported. Survey information will be summarized and reported by the Department of Plant Pathology, North Dakota State University. This information will provide assistance with diagnosis of tree diseases and help set future research priorities.

Nursery Diseases

Extensive damage to the 2-0 Engelmann spruce seedlings was encountered at the Coeur d'Alene Nursery in northern Idaho during the spring of 1980. Major pathogens associated with the needle and twig blight were Botrytis cinerea Pers. ex. Fr. and Phoma sp. Extended periods of cool, wet weather provided ideal conditions for buildup and proliferation of the diseases.

Grey mold caused by Botrytis cinerea continued to cause problems with containerized conifer production at the Coeur d'Alene Nursery. The disease was especially important on western larch, seriously restricting winter production of trees. Control tests of several fungicides are planned. These tests will provide efficacy data needed for chemical registration.

Tip blight caused by Sirococcus strobilinus Preuss was found in ponderosa pine seedlings at two private nurseries in northern Idaho. The disease resulted in tip dieback and mortality of 1-0 seedlings in bare root beds. Sources of inoculum were unknown; however cones from nearly mature ponderosa pine were suspected of harboring the pathogen.

Other Diseases

Foliage diseases were common during 1980 in the Northern Region. Several needle casts in addition to those mentioned previously were reported. The most important included Lirula abietis-concoloris (Mayr. ex Dearn.) Dark. on true fir and Lophodermella concolor (Dear.) Dark. on lodgepole pine. Fir needle rust (Puccinastrum epilobii Otth., P. goeppertianum (Keuhn) Kleb.) was common on the cooler, wet sites west of the Continental Divide. Common hardwood foliage diseases include Septoria musiva Pk. and Cercospora sp. on cottonwood.

Fire blight caused by the bacterium Erwinia amylovora (Burr.) Winsl. was common on orchard and ornamental apple trees in western and central Montana. Wet spring conditions were especially conducive to spread and buildup of this disease.

Weather-related disorders, especially those associated with extremely cold temperatures and spring frosts, were common in some areas. However, damage was not as extensive as in previous years.

The eruptions of Mt. St. Helens in 1980 caused blankets of volcanic ash over major portions of northern Idaho and western Montana. Effects of forest productivity and native disease incidence and severity are unknown.

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REPORTS AND ARTICLES - NORTHERN REGION
Issued During C.Y. 1980

Bennett, D. D., W. E. Bousfield, M. D. McGregor, and K. E. Gibson.
1980. Evaluation of multistage sampling techniques to measure lodgepole pine mortality caused by mountain pine beetle in Montana. Report 80-13.

Bennett, Dayle D., and Mark D. McGregor.
1980. A demonstration of basal area cutting to manage mountain pine beetle in second-growth ponderosa pine. (Progress Report No. 1.) Report 80-16.

Bousfield, W. E., and Tom Flavell.
1980. Effects of Dipel Wettable Powder for foliage protection against western spruce budworm 1 and 2 years following aerial application. Report 80-9.

Bousfield, Wayne E.
1980. The effects of height growth loss on stands damaged by the western spruce budworm. Report 80-11.

Dewey, J. E., and O. J. Dooling.
1980. Forest insect and disease conditions in the Northern Region, 1979. Report 80-7.

Dewey, J. E., and M. J. Jenkins.
1980. An evaluation of cone and seed insects in selected seed production areas in Region 1 (Progress Report No. II). Report 80-18.

Dooling, O. J.
1980. Regional summary of forest insects and diseases, 1979. Report 80-1. 13 p.

Dooling, O. J., and J. W. Byler.
1980. Evaluation of dwarf mistletoe control, Sula Ranger District, Bitterroot National Forest. Report 80-3. 7 p.

Dooling, O. J., and S. Haglund.
1980. Evaluation of proposed dwarf mistletoe loss assessment on the Bitterroot and Lolo National Forests, Montana. Report 80-14. 12 p.

Gibson, K. E., M. D. McGregor, and J. E. Dewey
1980. Evaluation of a mountain pine beetle infestation in second-growth ponderosa pine on the Crow Indian Reservation, Montana, 1979. Report 80-2.

Gibson, K. E., M. D. McGregor, and D. D. Bennett.
1980. Establishment Report: Permanent mountain pine beetle population trend plots, Montana 1979. Report 80-8.

Gibson, K. E., and D. D. Bennett.
1980. Mountain pine beetle status update, Plains RD, Lolo NF, 1979. Report 80-12.

Gillman, L. S., and R. L. James.
1980. Fungicidal tolerance of Botrytis within Colorado greenhouses. USDA Tree Planters' Notes 31(1):25-28.

Hard, John, Scott Tunnock, and R. Eder.
1980. Western spruce budworm defoliation trend relative to weather in the Northern Region, 1969-1979. Report 80-4.

James, R. L.
1980. Engelmann spruce needle and tip blight at the Coeur d'Alene Nursery, Idaho. Report 80-21. 5 p.

James, R. L., F. W. Cobb, Jr., P. R. Miller, and J. R. Parmeter, Jr.
1980. Effects of oxident air pollution on susceptibility of pine roots to Fomes annosus. Phytopathology 70:560-563.

James, R. L., F. W. Cobb, Jr., W. W. Wilcox, and D. L. Rowney.
1980. Effects of photochemical oxident injury of ponderosa and Jeffrey pines on susceptibility of sapwood and freshly-cut stumps to Fomes annosus. Phytopathology 70:704-708.

McGregor, Mark D., K. E. Gibson, and D. D. Bennett.
1980. Bark beetle conditions, 1979. Report 80-6.

McGregor, Mark D., K. E. Gibson, J. S. Hard, D. D. Bennett, and H. E. Meyer.
1980. Status of mountain pine beetle, Kootenai NF, Montana - 1979. Report 80-10.

McGregor, M. D., and D. D. Bennett.
1980. Progress Report No. 1 - Yaak and Thompson River demonstration areas to manage mountain pine beetle in lodgepole pine. Report 80-17.

Rice, John, and John Hard.
1980. Results of damage surveys in young Northern Region plantations. Report 80-15.

Stipe, Lawrence E., and John S. Hard.
1980. An early single tree application for Douglas-fir foliage and cone protection from the western spruce budworm. Report 80-3.

Tunnock, Scott, and John Hard.
1980. A budworm, Argyrotaenia sp., outbreak on the Wallace and Cabinet RD's, Idaho Panhandle and Kootenai NF's. Report 80-5.

Tunnock, Scott, and Hubert Meyer.
1980. Damage by the budworm, Argyrotaenia sp. Report 80-22.

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